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Spinning Performance of Machine and Hand-harvested Cotton, Upper Gulf Coast and Brazos Valley, 1957-58

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Cotton has been priced on grade, which includes cleanliness or trash content, for more than a century. In the days of all hand picking, high grades resulted from picking shortly after the bolls opened and before the fiber was discolored by weathering. When all cotton was hand picked, high grades produced yarns superior to those processed from low grades. Low grades were associated with field damage and late harvest.

A recent United States Department of Agriculture publication correlated grades and processing performance of the 1956 crop (1).[1] It reported that the average yarn appearance index declined appreciably as the grade decreased. The average for cotton classed as strict middling was 105 and for low middling 95.

In a progress report, Berkley reported: "An examination of the USDA reports on the fiber and spinning quality shows that for cottons, in general, from the 1956 crop there was no relationship between classer's grade and yarn appearance grades. Unless there is a change in harvesting and ginning, classer's grade can no longer be considered, therefore, an index of cotton quality. Mills will soon learn to disregard grade, except for mill waste, and price differences will be based on the expected mill loss and on color." (2)

A Southwestern farm paper commented recently: "Spinners at the recent Spinner-Breeder conference in Lubbock stated frankly that they had turned from high grade cottons for the simple reason that the lower grades showed better character, less damage." (3)

All of these statements are not in agreement. The two in conflict are based on the 1956 crop. The 1957 crop contained a greater percentage of low grades than that of any recent season.

A study was made by the Texas Agricultural Experiment Station during the crop years of 1956, 1957 and 1958 on the processing performance of cottons that were hand harvested and machine picked, but grown under similar conditions. Areas chosen for the tests were Wharton and Fort Bend counties in the Upper Gulf Coast and Burleson, Brazos and Robertson counties in Central East Texas.

Deltapine is the predominant type of cotton grown in each area.

Machine-picked and hand-harvested cottons of similar harvest periods were sampled at the gin. Spinning performance tests were run on each bale. These tests were analyzed on the basis of fiber properties, grade index, color, percentage of picker and card waste, and average break factor and yarn appearance index of 22's and 50's yarn.

Although machine-picked cotton may in some instances be very low grade, no effort was made to avoid poor quality cotton during the assembly of the samples of this study. The test samples of the two types of harvesting were collected in such a way as to avoid bias. Samples of each type were obtained on the same day or under similar conditions. Several of the machine-picked bales were from second picking. Analysis of the quality factors of the two methods of harvesting indicated only a small quality difference. The machine-picked cotton was superior in several quality factors.

Part of the tests of cottons from the 1956 crop was processed by one laboratory and a check lot by another. The results indicated that these laboratories were operating on a marked difference in level of performance. All of the tests of the 1957 and 1958 crops were transferred to one laboratory. This laboratory offered a wider range in facilities.

This publication is confined to test results of the 1957 and 1958 crop. The 1956 results are reported in Progress Report 1963. (4) The findings correlate with those of the 1957 and 1958 crops.

[1]Numbers in parentheses refer to literature cited.

CHANGES IN GINNING

Marked changes in ginning techniques occurred in the 1957 and 1958 ginning seasons. Many gin plants installed one or more saw-type lint cleaners. This resulted in a distinct improvement in the grade of the cotton ginned.

In 1957, due to a shortage of high grades, American mills were forced to shift to medium and lower grades. The mills have learned that some of the high grades have been subjected to excessive drying and machining during ginning. This affects spinning performance adversely. Lower grades frequently process more satisfactorily and produce acceptable yarn.

INCREASED USE OF MECHANICAL HARVESTING

The trend to mechanization of cotton harvesting has been underway for some time. It is difficult to justify the cost of hand harvesting. Even on a custom basis, the cost of machine picking is 25 percent lower than that of hand pulling. Machine picking and hand pulling have brought about the use of increased drying and cleaning facilities in gin plants. The manner in which these facilities are used, as well as the condition of the seed cotton when ginned, determine the mill processing performance of the ginned fiber.

Machine-picked cotton frequently is carried to gins equipped with dryers, overhead cleaners and one or more stages of lint cleaning designed to gin fiber from this type of harvest. Hand-picked cotton also is processed through the same series of machines. This has a tendency to equalize the processing performance of the two types of harvest. Spinning tests results of this project tend to confirm this observation.

UPPER GULF COAST

Table 1 shows average fiber properties and spinning data on eight machine-picked bales and a lot consisting of four bales of machine and hand-picked cotton produced in the Upper Gulf Coast during 1957-58. The differences in fiber fineness, tensile strength and length were not significant. The colorimeter and picker and card waste data confirm the classer's grade, strict low middling and middling. The average yarn break factor and yarn appearance grade were similar. After allowance for the value of the spinning waste difference, the higher-priced, high-grade cotton apparently is over-valued in comparison with the lower-grade, machine-picked fiber.

Table 2 contains data on two hand-picked bales from the 1957 crop which were ginned

TABLE 1. FIBER PROPERTIES AND SPINNING PERFORMANCE OF COTTON GRADED MIDDLING AND STRICT LOW MIDDLING, AUGUST-SEPTEMBER 1957 AND 1958 HARVEST, UPPER GULF COAST[1]

Harvest method	Tests, number	Maturity index [2]	Fineness micrograms per inch [3]	Fiber tensile strength 000's pounds per square inch zero gauge [4]	Length U.H.M., inches [5]	Grade index [6]	Colorimeter		Waste picker & card, percent [8]	Average yarn break factor, 22s & 50s [9]	Average yarn appearance, 22s & 50s index [10]
							Rd [7]	+b			
Machine-picked, 1957 average	8	77	4.1	86	1.00	92	71.3	8.9	9.45	2415	102
Machine & hand-picked, 1958 average	4	79	4.3	86	1.02	101	73.5	9.3	6.64	2400	104

[1]Project field samples processed at a card production rate of 9½ pounds per hour by AMS, U.S. Department of Agriculture.

[2]Maturity index is the ratio of the untreated to the treated Causticaire readings multiplied by 100: above 81 is mature, 76 to 81 average and 70 to 75 is immature.

[3]Fiber fineness is linear density expressed in terms of micrograms per inch: 3.0 to 3.9 is fine, 4.0 to 4.9 average, 5.0 to 5.9 coarse and 6.0 and above very coarse.

[4]Fiber strength is the force in 1,000 pounds required to break the equivalent of a surface area of 1 square inch calculated from the Pressley index: 86 to 95 is strong, 76 to 85 average, 66 to 75 fair and 65 or less is weak.

[5]Expressed in terms of the upper-half-mean which is the average length of the longest half of the fiber array by weight. This corresponds closely to staple length as determined by classers: .92-.96 equals 15/16 inch, .95-.99 equals 31/32 inch, .98-1.02 equals 1 inch, 1.01-1.05 equals 1-1/32 inches, 1.04-1.08 equals 1-2/32 inches and 1.07-1.11 equals 1-3/32 inches.

[6]Grade index: 104 is strict middling, 100 middling, 94 strict low middling, 85 low middling, 76 strict good ordinary and 70 good ordinary.

[7]Color by the Colorimeter. The color values are percentages reflectance in terms of Rd and yellowness in terms of +b. Increasing Rd values indicate increasing brightness and increasing +b values indicate increasing degrees of yellowness.

[8]Past experience has shown the average relationship between grade and manufacturing waste as based on medium staple Upland cottons when carded at 9½ pounds per hour, is approximately as follows: Good Middling, 6.3%; Strict Middling, 7.2%; Middling, 8.1%; Strict Low Middling, 9.3%; Low Middling, 12.5%; Strict Good Ordinary, 15.6%; and Good Ordinary, 18.3%.

[9]The break factor is obtained by multiplying the yarn strength times the yarn number and averaging these values for the two standard numbers spun.

[10]Yarn appearance refers to the relative evenness, smoothness and freedom from foreign material of the yarn as evaluated by a visual comparison with the standards adopted by the American Society for Testing Materials. An index of 100 is average, 110 good and 120 very good.

TABLE 2. FIBER PROPERTIES AND SPINNING PERFORMANCE OF COTTON GRADED LOW MIDDLING PLUS AND STRICT LOW MIDDLING, AUGUST-SEPTEMBER 1957 AND 1958 HARVEST, UPPER GULF COAST

Harvest method	Tests, number	Maturity index	Fineness micrograms per inch	Fiber tensile strength, 000's pounds per square inch, zero gauge	Length U.H.M., inches	Grade index	Colorimeter		Waste picker & card, percent	Average yarn break factor, 22s & 50s	Average yarn appearance, 22s & 50s index
							Rd	+b			
Hand-picked, 1957 average	2	78	4.2	84	1.02	89	70.1	8.0	9.91	2437	100
Machine & hand-picked, 1958 average	3	77	4.1	85	1.02	94	70.4	9.2	8.48	2422	98

without lint cleaning. These are compared with three bales of the 1958 crop processed through gins having three combinations of lint cleaners—single-saw, air-jet followed by saw and tandem saw. The latter cotton obviously was subjected to more machining than the 1957 cotton. The hand-picked, non-lint-cleaned cotton was classed low middling plus, the lint-cleaned lot strict low middling. These grades were confirmed by the color and spinning waste data. There was no significant difference in other fiber properties or yarn quality. After allowance for the spinning waste difference, the higher grade, lint-cleaned cotton is over-valued $4.00 per bale.

BRAZOS VALLEY

Six bales classed low middling and six classed strict low middling are compared in Table 3. They were grown in 1957 and 1958, respectively. The ginning processes of each lot were similar.

The fiber properties of maturity index and fineness were slightly superior in the strict low middling cotton. The colorimeter data confirm the classer's grade, but the spinning waste does not; the low middling having a waste equivalent to strict low middling and the strict low middling having waste equal to strict middling. Other fiber properties and yarn quality were similar within the range of acceptable tolerances.

When allowance is made for the spinning waste difference, the higher-grade strict low middling cotton is over-valued $12.00 per bale.

Hand-pulled and machine-picked cottons from the same farm are contrasted in Table 4. The range in fiber properties within each harvest group is narrow. There was no significant difference in the average fiber properties of the two groups. The range in average grade index is narrow, slightly less than one-half of a grade. The machine-picked cotton was graded slightly above the hand-pulled. The average difference in color was not significant. Average yarn break factor and appearance grade of 22's and 50's yarn were similar. The picker and card waste was slightly lower for the machine-picked part of the crop. Although the machine-picked cotton graded slightly higher and had less spinning waste, these differences do not justify all of the narrow quality spread indicated by the classer's grade. The hand-pulled cotton had more bur and other trash content before ginning. The gin had a limited capacity to remove trash from the fiber. The seed cotton having the greatest trash content before ginning had a similar waste percentage after ginning. Although spinning performance was similar, the hand-pulled cotton had the better spinning value. It could be purchased at a lower price because it was assigned a lower average grade by the classer. After allowance for the spinning waste difference, the higher-grade cotton was over-valued $6.00 per bale.

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TABLE 3. FIBER PROPERTIES AND SPINNING PERFORMANCE OF COTTON GRADED LOW MIDDLING AND STRICT LOW MIDDLING, SEPTEMBER-OCTOBER 1957 AND 1958 HARVEST, BRAZOS VALLEY

Harvest method	Tests, number	Maturity index	Fineness, micrograms per inch	Fiber tensile strength, 000's pounds per square inch, zero gauge	Length U.H.M., inches	Grade index	Colorimeter		Waste picker & card, percent	Average yarn break factor, 22s & 50s	Average yarn appearance, 22s & 50s index
							Rd	+b			
Machine-picked, 1957 average	6	78	4.1	81	1.07	85	68.0	7.8	9.11	2379	105
Machine & hand-picked, 1958 average	6	81	4.6	81	1.09	94	71.9	8.4	7.17	2344	101

TABLE 4. FIBER PROPERTIES AND SPINNING PERFORMANCE OF HAND-PULLED AND MACHINE-PICKED COTTONS GROWN ON THE SAME FARM, SEPTEMBER-OCTOBER 1958 HARVEST, BRAZOS VALLEY

Harvest method	Tests, number	Maturity index	Fineness, micrograms per inch	Fiber tensile strength, 000's pounds per square inch, zero gauge	Length U.H.M., inches	Grade index	Colorimeter		Waste picker & card, percent	Average yarn break factor, 22s & 50s	Average yarn appearance, 22s & 50s index
							Rd	+b			
Hand-pulled	4	79	4.5	81	1.11	86	70.9	7.7	8.60	2388	100
Machine-picked	5	80	4.6	80	1.10	89	70.1	7.8	7.71	2366	102

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